Title: North London

LPN Regional Development Plan

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Version: 1.4

Date: March 2014

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Document History

Version	Date	Revision Class	Originator	Section Update	Details
1.0	June 2013		S. Motte		First Draft for review
1.1	June 2013		S. Motte		Amendments following review
1.2	21/02/2014	Major	Z. Musanhi	1	Updated list of projects and costs
1.2	21/02/2014	Major	Z. Musanhi	1	Costs profile table updated
1.2	21/02/2014	Major	Z. Musanhi	1	LI and HI charts updated
1.2	21/02/2014	Major	Z. Musanhi	2.1	Updated list of substations in RDP
1.2	21/02/2014	Major	Z. Musanhi	2.2	Updated Table 3 (NAMP extract)
1.2	21/02/2014	Major	Z. Musanhi	2.2.1	Updated projects
1.2	21/02/2014	Major	Z. Musanhi	2.2.2	Updated with correct project titles
1.2	21/02/2014	Major	Z. Musanhi	3.2	Updated HI tables
1.2	21/02/2014	Minor	Z. Musanhi	3.3	P2/6 table and Table 7 updated
1.2	21/02/2014	Major	Z. Musanhi	4.1	Project scope amended
1.2	21/02/2014	Major	Z. Musanhi	4.2	Unwanted projects removed
1.2	21/02/2014	Major	Z. Musanhi	4.3	Table 9 updated
1.2	21/02/2014	Major	Z. Musanhi	4.4	HI tables updated
1.3	20/03/2014	Minor	Z. Musanhi	Contents	Contents page amended
1.3	20/03/2014	Minor	Z. Musanhi	All	Font face changed to Arial
1.4	27/03/2014	Minor	Regulation	All	Final publication

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Contents

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1 Executive Summary

This development plan reviews the LPN EHV network in the North London area. This network is currently supplied by several GSPs, mainly Hackney and West Ham.

The most significant change to the network results from the establishment of the new GSP at Islington. This on-going project is essential to provide additional capacity in the area. Once commissioned, this GSP will allow the reinforcement of several primary substations following their upgrade at 132kV. It will also address asset condition issues of cables and switchgear.

Reinforcement schemes are proposed at several primary substations with Hatchard Rd being upgraded at 132kV and Whiston Rd being replanted on a new site (in the Hoxton area, exact location not yet identified); both substations will be supplied from Islington GSP. Waterloo Rd will be upgraded at 132kV from Hackney 132kV with the new cables installed in the tunnel that will be built for the Hackney-Exeter Rd gas cable replacement scheme.

Selective and targeted asset replacement schemes are proposed to maintain the reliability of switchgear, transformers and cables.

Proposed projects

Reinforcement Schemes

- Hatchard Rd - Replant as 132/11kV substation (2x66.6MVA) £12.1M
- King Henry's Walk - Replant as 132/11kV substation (3x33.3MVA) £10.7M
- Waterloo Rd - Replant as 132/11kV substation (2x66.6MVA) £13.2M
- New 132/11kV substation in Hoxton area (2x33.3MVA) £13.9M (£10.3M in ED1)
- Hackney-Waterloo Rd cable tunnel £17.3M (£15.6M in ED1)

Asset Replacement Schemes

- Hackney to Exeter Road 66kV gas cable replacement £2.1M
- Hackney-Exeter Rd 66kV-Replace FFC (Mollerhoj) £2.0M
- Hackney-King Henrys Walk 66kV gas cable scheme £5.1M
- Hackney 66kV: replace switchgear £13.3M
- Edwards Lane A: Replace switchgear £1.9M (£1.7M in ED1)

Costs profile

Cat.	Reference	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
A&H		Total Asset Replacement	0	2,835	3,671	4,564	10,537	2,868	266	0	0	0
R		Total Reinforcement	203	1,537	4,198	6,344	6,138	8,837	16,469	16,879	11,868	4,380
		Grand Total	203	4,372	7,869	10,908	16,675	11,705	16,736	16,879	11,868	4,380

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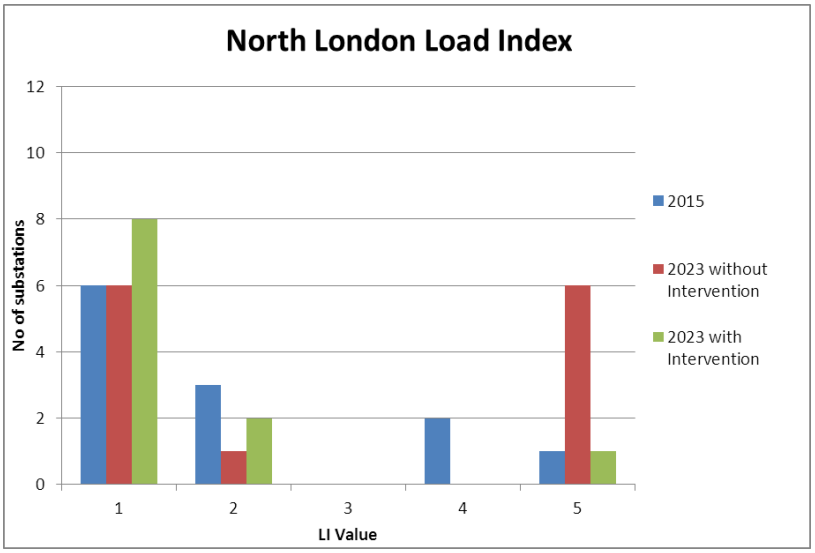
Output Measures – Load Index

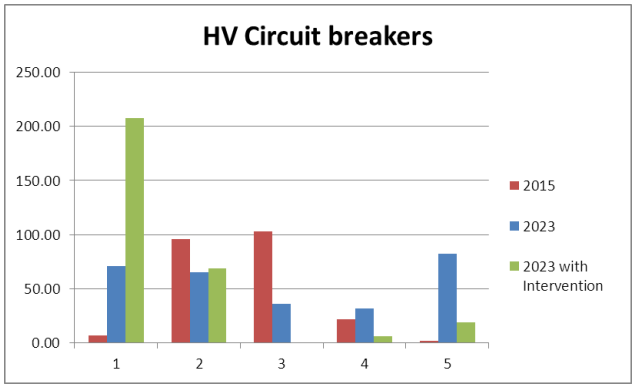
The chart below illustrates the LI profile of the grid and primary substations covered in this RDP.

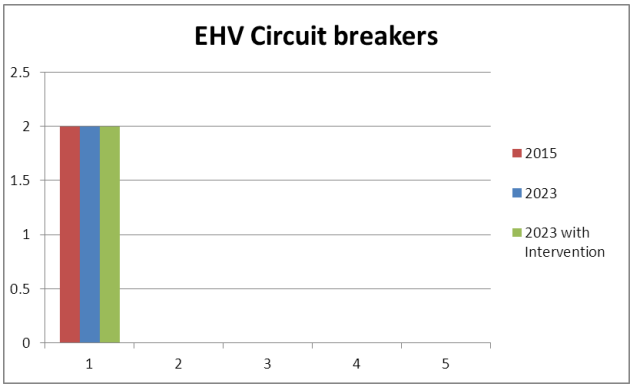


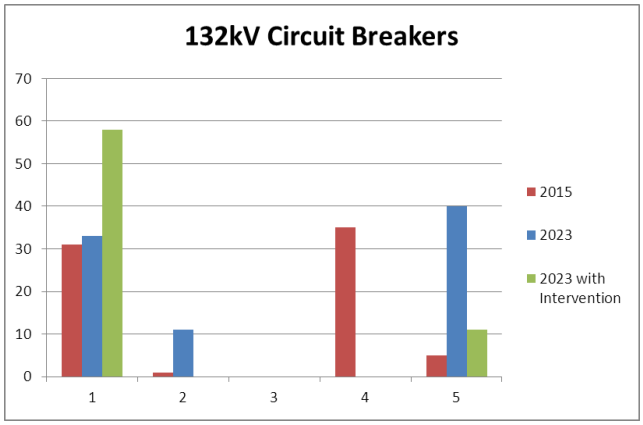
The number of substations decreases from 13 in 2015 to 11 in 2023 due to the decommissioning of Holloway 66kV and St Pancras A&B (replaced by St Pancras C).

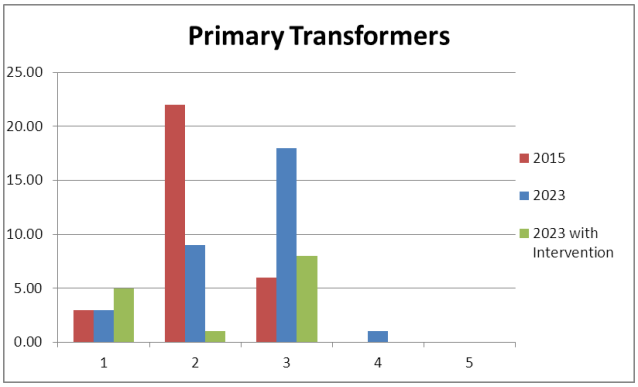
Output Measures – Health Index

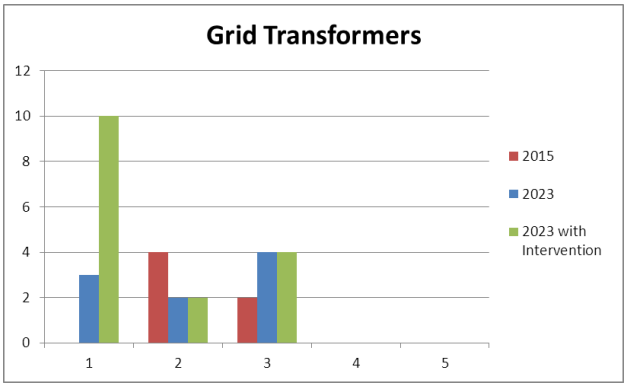
The forecast health indices for 2015 and 2023, with and without intervention, for each plant category are detailed below:











Principal Risks and Dependencies

The schemes covered in this RDP have been planned based on the planning load estimates 2013 with the 2011/12 maximum demand. The load forecasts are based on the element energy model. If the economic situation improves there is a risk that there will be shortfall of reinforcement schemes in the plan.

The load forecasts also include an assumed level of embedded generation being connected to the network. Should this generation not materialise, then a larger than forecast load growth could be realised.

Where Demand Side Response has been included at a substation, this is based on an assumption that customers will be willing to accept the scheme. In most cases these customers have not as yet been identified.

2 Network configuration

2.1 Existing Network

This Regional Development Plan reviews the LPN network covering the area from St John's Wood in the West, to Hackney in the East and from Hatchard Road in the North to City Road in the South.

Part of the network is supplied from Hackney Supergrid 132kV and Hackney Supergrid 66kV GSPs. The rest of the area is currently fed from West Ham (via Brunswick Wharf), Lodge Rd and City Rd GSPs. Geographical and network diagrams (Single Line Diagrams) are included in Appendices A, B, C and D.

The substations covered in this RDP are:

- St Pancras A&B
- Hatchard Rd
- Holloway 11kV
- Holloway Grid 66kV
- Islington
- King Henry's Walk
- Whiston Rd
- Hackney Grid 66kV
- Hackney C
- Waterloo Rd
- Blackhorse Lane
- Exeter Rd
- Edwards Lane
- Bow 132kV
- Hearn Street
- Shoreditch 66kV

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

2.2 Projects in progress

Table 1. **NAMP Table J (less indirect costs) 19th February 2014**

Cat.	Reference	Description	2013/14	2014/15	2015/16	2016/17	2017/18
A	1.51.03.3517	Hackney 66kV: Replace 66/6.6kV T2	564	150	0	0	0
A	1.54.01.3731	St Pancras: Substation Asset Replacement Phase 1	2,216	1,218	0	0	0
A	1.54.01.5410	St Pancras: Substation Asset Replacement Phase 2	1,764	2,352	0	0	0
R	1.33.03.5825	King Henrys Walk 11kV Switchboard Extension	35	0	0	0	0
R	1.34.01.5525	Islington Uprate 6.6kV Network to 11kV	177	0	0	0	0
R	1.34.02.5723	Whiston Rd North Group Reinforcement	380	0	0	0	0
R	1.34.02.5880	Create a Post-fault Transfer from Edwards Lane C Group to King Henry's Walk	90	68	0	0	0
R	1.35.01.4252	Edwards Lane 66/11kV - ITC (add 2x30MVA)	264	865	1,807	0	0
R	1.35.07.3724	Islington: Establish New 400/132kV GSP	2,256	3,932	2,725	62	0
R	1.37.06.4368	Holloway / Islington: 132kV Network Reconfiguration	0	0	150	68	0
A	1.48.09.5571	Shoreditch 66kV Grid Substation: Replace 66kV CBs	103	243	71	0	0

2.2.1 Asset Replacement

3517 - Hackney 66kV: Replace 66/6.6kV T2

The existing 66/6.6kV T2 transformer at Hackney C has been identified for asset replacement as a consequence of dissolved gas analysis (DGA) and furfur aldehyde analysis (FFA), tap changer type, oil leaks and number of failures.

The transformer will be replaced by a unit with the same rating; however the impedance has been specified so that the reactors can be removed.

3731 - St Pancras: Substation Asset Replacement Phase 1

St Pancras 11kV switchgear needs to be replaced for the following reasons: the shutter mechanism is causing problems and was broken in several instances; and the isolating contacts are overheating causing the bitumen compound to melt and leak therefore causing problems when taking the breakers in and out.

St Pancras substation consists of two 11kV switchboards: St Pancras A (23 bays) and St Pancras B (27 bays). Three additional bays are connected to the lower bar of St Pancras B through six cables. The existing 11kV switchgear is Reyrolle C6T from 1963. Both switchboards are being replaced under this scheme.

The deliverables of this project are:

- Demolition of a redundant four storey workshop building (Georgiana Street building)
- Construction of a new three storey switch-house
- Installation of a new 2500A 11kV switchboard (St Pancras C)

5410 - St Pancras: Substation Asset Replacement Phase 2

It is proposed to replace the existing four 66/11kV transformers with three new 66.6MVA 132/11kV units supplied from the new Islington GSP. The new 132kV cables will be installed either in an open-cut route or in the National Grid deep cable tunnel which has connecting shafts at Islington and St Pancras. Both cabling options are currently being investigated.

5571 - Shoreditch 66kV Grid Substation: Replace 66kV CBs

The six BTH OW409 66kV oil circuit breakers at Shoreditch 66kV date from 1931 and five of them are HI5. The OCB mechanisms, OCB bushings and through-roof oil filled bushings are all in very poor condition. Many of the bushings are suffering from oil leaks of varying severity. Due to the nature of the site and bus bar configuration, it is not possible to economically repair or replace the bushings. It is not possible to repair or refurbish the circuit breakers and they need to be replaced or otherwise removed from service. This scheme allows for the asset replacement of the five OCBs' with dead tank circuit breakers as they need replacing urgently for safety reasons. When Hearn Street substation is upgraded to 132kV (refer to New Cross RDP) the circuit breakers will be reused at other sites.

2.2.2 Reinforcement

5880 - Create a Post-fault transfer from Edwards Lane to King Henry's Walk

Edwards Lane is at firm capacity and provision has been made to create a partial transfer of the Central Group to King Henry's Walk substation to keep the group N-1 compliant and to reduce peak demand at Edwards Lane main substation to keep it within firm until the ITC scheme is complete (project 4252). This scheme is linked to the project listed below.

5825 - King Henry's Walk 11kV switchboard extension

Two additional circuit breakers (single busbar) will be added to the 11kV switchboard at King Henry's Walk. These breakers, together with two idle 11kV cables will be used to create 8MVA of post fault transfer from Edwards Lane to King Henry's Walk.

5723 - Whiston Rd North Group Reinforcement

The Whiston Road North Group is at risk of being non P2/6 compliant. This project will provide two 11kV interconnectors with City Road B using ex 33kV cables, which are currently idle.

3724 - Islington: Establish new 400/132kV GSP

This project consists of the construction of a new 3x240MVA 400/132kV GSP in Islington. This GSP will create additional capacity in the North London area and will enable reinforcement at nearby primary substations. The scope of work includes joint development of a combined new National Grid/UKPN substation on the ex-Islington 66kV substation site to be supplied by 132kV transformer tails installed in the new National Grid deep cable tunnel between St Johns Wood and Hackney. NG's SGTs and 400kV substation will be located on their site in Finsbury Park.

4368 - Holloway / Islington: 132kV network reconfiguration

This project is linked to the scheme above. It provides for the reconfiguration of the Holloway-Brunswick Wharf double circuit at the new Islington GSP. At Islington, the cables are routed across the Islington site before entering the existing tunnel to Holloway. The circuits are to be looped into the new 132kV switchboard.

5525 - Islington uprate 6.6kV network to 11kV

This project is to uprate the Islington 6.6kV network to 11kV so that the 11/6.6kV auto-transformers at Islington can be removed (required to allow National Grid to build their shaft and head house as part of the new GSP project). The 6.6kV switchboard sits on land leased from the church. The uprated network will be supplied directly from Holloway 11kV. This project includes new 11kV cables from Holloway to the Islington network, and replacement of distribution transformers. A thermal modelling of the tunnel has been carried out to make sure the proposed load on the 11kV cables does not trigger any overheating.

4252 - Edwards Lane 66/11kV - ITC (add 2x30MVA)

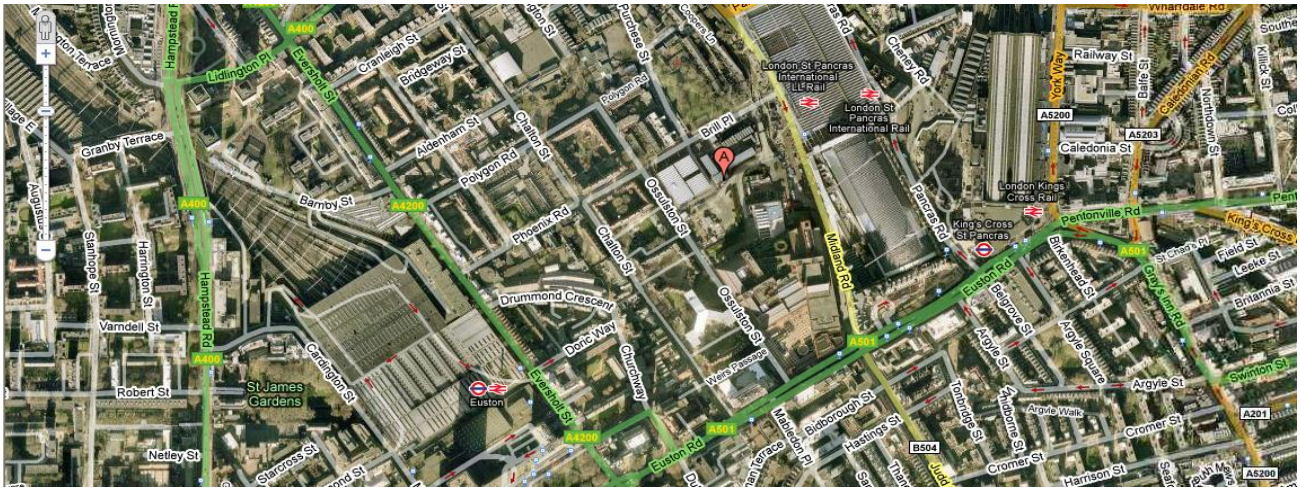
Due to forecast increasing demand levels it is proposed to add two 30MVA transformers fed via two new circuits from Hackney. An application has been made to OFGEM for extension of the Edwards Lane site derogation.

3 Network Development Considerations

3.1 Development areas

Brill Place NW1 1HG

The Francis Crick Institute is a joint project between the University of London and pharmaceutical companies to develop a bio-research centre close to Kings Cross, St Pancras.



Construction is scheduled for completion in 2015 with an estimated maximum demand of 15MVA. The complex is designed to be a sustainable development with combined heat and power (CHP) and solar panel systems including 5.6MVA of standby generation.

The site is to be supplied from St Pancras substation via 4 x 11kV circuits, initially from Lodge Road GSP then transferring to Islington GSP.

3.2 Asset Health

It should be noted that HIs presented in the RDP will not align with the RIGS. The HIs presented in the RDP are the outcome of our ARP models on an asset by asset basis. Different rules are applied for RIGs reporting, as agreed with Ofgem, where assets may be grouped and all assets in the group take the same HI.

The forecast asset health index **(without intervention)** for switchgear and transformers are tabulated below.

Table 1. **HV Circuit Breakers (6.6 and 11kV)**

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
BLACKHORSE LANE			21	4					6	19
EDWARDS LANE A			28						12	16
EXETER RD			9	15	2				1	25
HACKNEY C 6.6kV	1	43				1	43			
HATCHARD RD		19	4				1	21	1	
KING HENRYS WALK 11kV	4	23				4	8	15		
WATERLOO RD			25	1					8	18
ST PANCRAS C			n/a			66				
HEARN STREET	2	11	16	2			13		4	14

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Table 2. **EHV Circuit breakers (22kV)**

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BOW NETWORK RAIL 25kV	2					2				

Table 3. **66 and 132kV Circuit Breakers**

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BOW 132kV	10					10				
HACKNEY GRID 66kV				22						22
HACKNEY SGRID 66kV				11						11
HACKNEY SUPERGRID 132kV	11					11				
HOLLOWAY GRID 66kV	10						10			
KING HENRYS WALK 66kV				2						2
ISLINGTON GSP			n/a			12				
SHOREDITCH 66kV		1			5		1			5

Table 4. **Primary Transformers**

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BLACKHORSE LANE		1	2					3		
BOW NETWORK RAIL 25kV	2					2				
EDWARDS LANE A		4						4		
EXETER RD		4					1	3		
HACKNEY C 6.6kV	1		2			1		2		
HATCHARD RD		4					4			
KING HENRYS WALK 11kV		4						4		
WATERLOO RD		3	1				3	1		
HEARN STREET		2	1				1	1	1	

Table 5. **Grid Transformers**

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
HACKNEY GRID 66kV		2	2				2	2		
HOLLOWAY GRID 66kV		2						2		
ST PANCRAS C			n/a			3				

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3.3 Security of supply analysis

Table 6 shows the load growth predicted on the North London network. Where loads exceed the substation firm capacity plus any post fault transfer capability they are shown in orange.

Table 6. **P2/6 Analysis**

Sub-station	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	P. F.	Winter 12/13 Summer 2012 (MW)	Winter 13/14 Summer 2013 (MW)	Winter 14/15 Summer 2014 (MW)	Winter 15/16 Summer 2015 (MW)	Winter 16/17 Summer 2016 (MW)	Winter 17/18 Summer 2017 (MW)	Winter 18/19 Summer 2018 (MW)	Winter 19/20 Summer 2019 (MW)	Winter 20/21 Summer 2020 (MW)	Winter 21/22 Summer 2021 (MW)	Winter 22/23 Summer 2022 (MW)
Whiston Road	11kV	46.09	11.14	0.96	45.05	45.57	46.39	47.24	47.93	-0.60	-0.60	-0.60	-0.60	-0.60	-0.60
Whiston Road	11kV	42.30		0.94	32.28	32.63	33.18	33.76	34.22	0.00	0.00	0.00	0.00	0.00	0.00
Bow 132kV BB	132kV	0.00		0.96	37.43	17.32	33.80	40.40	40.40	40.40	40.40	40.40	40.40	40.40	40.40
Bow 132kV BB	132kV	0.00		0.96	31.17	24.44	38.24	43.76	43.76	43.76	43.76	43.76	43.76	43.76	43.76
Hackney 132kV		553.00		0.96	196.51	151.74	168.41	176.21	177.71	179.42	181.19	130.44	131.74	133.30	134.90
Hackney 132kV		488.00		0.96	158.10	128.51	142.48	148.95	150.12	151.46	152.84	113.72	114.77	116.02	117.29
Hackney C.	6.6kV	52.53	0.43	0.98	39.61	39.82	40.20	40.61	40.95	41.34	41.74	42.14	42.55	43.12	43.70
Hackney C.	6.6kV	51.46	0.43	0.96	26.24	26.37	26.61	26.88	27.10	27.35	27.60	27.86	28.12	28.49	28.86
Hackney Grid 66kV.	66kV	224.60		0.96	124.44	125.63	127.56	129.59	131.25	133.13	135.08	84.47	85.91	87.63	89.40
Hackney Grid 66kV.	66kV	165.60		0.92	94.47	95.41	96.92	98.49	99.78	101.24	102.76	63.74	64.89	66.26	67.66
Hearn Street.	11kV	50.00	8.82	0.98	39.30	40.00	41.06	42.13	42.99	43.98	45.00	46.05	47.13	48.35	49.59
Hearn Street.	11kV	42.75	8.55	0.95	37.72	38.35	39.31	40.29	41.07	41.97	42.90	43.85	44.83	45.94	47.07
King Henry's Walk.	11kV	56.70		0.97	48.81	49.14	49.71	50.32	50.83	51.41	52.01	0.00	0.00	0.00	0.00
King Henry's Walk.	11kV	41.40		0.92	37.78	38.03	38.45	38.90	39.28	39.70	40.15	0.00	0.00	0.00	0.00
Shoreditch 66kV Busbar	66	0.00		0.98	39.41	40.11	41.17	42.24	43.11	44.10	45.12	46.17	47.25	48.46	49.71
Shoreditch 66kV Busbar	66	0.00		0.95	37.72	38.35	39.31	40.29	41.07	41.97	42.90	43.85	44.83	45.94	47.07
Blackhorse Lane	11kV	37.44		0.96	26.17	26.26	26.42	26.60	26.75	26.92	27.09	27.26	27.44	27.69	27.95
Blackhorse Lane	11kV	28.20		0.94	18.00	18.06	18.17	18.29	18.39	18.50	18.61	18.73	18.85	19.02	19.19
Edwards Lane	11kV	57.33	1.23	0.98	58.29	58.66	59.31	60.02	60.62	61.30	62.00	62.72	63.46	64.48	65.51
Edwards Lane	11kV	42.30		0.94	40.18	40.43	40.86	41.33	41.72	42.17	42.63	43.11	43.60	44.27	44.95
Exeter Road	11kV	57.33		0.98	39.18	39.43	39.88	40.37	40.78	41.25	41.72	42.21	42.70	43.38	44.07
Exeter Road	11kV	42.30		0.94	27.80	27.97	28.28	28.62	28.90	29.22	29.54	29.88	30.22	30.68	31.16
Hackney Supergrid 66kV	66kV	192.06		0.97	180.50	181.55	183.37	185.36	187.02	188.90	190.84	192.81	194.83	197.59	200.39
Hackney Supergrid 66kV	66kV	185.10		0.97	118.43	119.11	120.30	121.60	122.69	123.91	125.18	126.47	127.79	129.59	131.42
Waterloo Road	11kV	57.33	12.74	0.98	56.79	57.16	57.78	58.45	59.01	59.64	60.28	60.94	61.61	62.50	63.42
Waterloo Road	11kV	43.65		0.97	35.34	35.56	35.93	36.34	36.67	37.05	37.44	37.84	38.24	38.78	39.33
Hatchard Road 132/11	11kV	82.40		0.96	0.00	0.00	0.00	0.00	50.61	51.29	52.01	52.75	53.51	54.51	55.52
Hatchard Road 132/11	11kV	60.70		0.92	0.00	0.00	0.00	0.00	34.84	35.53	36.25	36.98	37.74	38.74	39.75
Islington 132kV	132kV	553.00		0.96	0.00	0.00	0.00	0.00	171.76	223.09	226.00	285.56	289.27	294.07	298.92
Islington 132kV	132kV	488.40		0.96	0.00	0.00	0.00	0.00	137.90	174.92	177.84	222.96	226.67	231.46	236.32
King Henry's Walk 132/11	11kV	82.40		0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.58	57.21	58.07	58.94
King Henry's Walk 132/11	11kV	63.40		0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.14	42.77	43.63	44.50
St Pancras C.	11kV	166.10		0.96	0.00	0.00	0.00	0.00	77.27	78.09	78.95	79.84	80.75	81.91	83.09
St Pancras C.	11kV	141.90		0.96	0.00	0.00	0.00	0.00	70.08	70.90	71.76	72.65	73.56	74.72	75.90
Whiston Road 132/11	11kV	82.40		0.96	0.00	0.00	0.00	0.00	0.00	49.32	50.13	50.96	51.81	52.84	53.89
Whiston Road 132/11	11kV	60.70		0.92	0.00	0.00	0.00	0.00	0.00	35.01	35.82	36.65	37.50	38.53	39.58
Hatchard Road	11kV	54.41	6.42	0.93	48.19	48.59	49.27	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hatchard Road	11kV	41.85		0.93	33.04	33.31	33.76	34.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Holloway	11kV	76.44		0.98	42.34	42.58	42.74	42.91	-1.25	-1.25	-1.25	-1.25	-1.25	-1.25	-1.25
Holloway	11kV	55.80		0.93	31.12	31.35	31.58	31.84	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71	-0.71
Holloway Grid 66kV	66kV	76.44		0.98	48.15	48.56	49.24	49.96	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
Holloway Grid 66kV	66kV	56.40		0.94	33.08	33.34	33.79	34.27	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
Islington	6.6kV	45.40		0.97	25.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Islington	6.6kV	33.48		0.93	17.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 7. **Substation LI Profile (without Investment)**

Substation	Voltage kV	Load Index	
		2015	2023
Hatchard Road	66/11	2.00	5.00
Holloway	132/11	1.00	1.00
Holloway Grid 66kV	132/66	1.00	1.00
Islington	11/6.6	n/a	n/a
Hackney C.	66/6.6	1.00	2.00
Hackney Grid 66kV.	132/66	1.00	1.00
King Henry's Walk.	66/11	2.00	5.00
Blackhorse Lane	66/11	1.00	1.00
Edwards Lane	66/11	5.00	5.00
Exeter Road	66/11	1.00	1.00
Waterloo Road	66/11	4.00	5.00
Whiston Rd	33/11	4.00	5.00
St Pancras C	132/11	n/a	1.00
Hearn Street	66/11	2.00	5.00

Hearn Street: The site is identified as LI5 and is to be replanted as a 132/11kV fed from New Cross 132kV via Osborn Street 132kV *(see New Cross RDP)*.

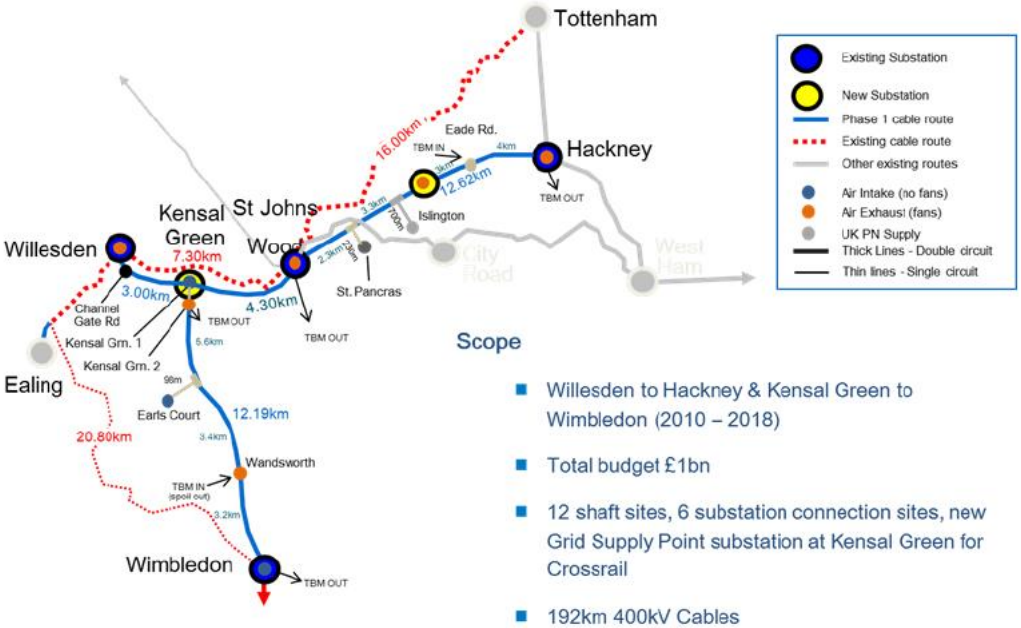
3.4 Operational and technical constraints

No operational restrictions have been identified

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

3.5 National Grid

In order to supply the London substations with the necessary energy to keep up with demand, National Grid is constructing more than 30km of underground tunnels that will carry the 400kV transmission cables. One of the tunnels will connect substations in Willesden, St John's Wood and Hackney with intermediate shafts at several locations including UKPN substations at St Pancras and Islington. Two 400kV circuits will be installed in this tunnel and looped in at Finsbury Park to supply the new Islington GSP.



Scope

- Willesden to Hackney & Kensal Green to Wimbledon (2010 – 2018)
- Total budget £1bn
- 12 shaft sites, 6 substation connection sites, new Grid Supply Point substation at Kensal Green for Crossrail
- 192km 400kV Cables
- 30km 132kV Cables

3.6 Smart Demand Response

Two sites have been identified as suitable for implementation of Demand Side Response (DSR) in ED1:

Whiston Rd: 5MVA of DSR will be used to mitigate the impact during the replanting of the station to create the new substation at Hoxton by reducing loading e.g. to widen outage windows.

St Pancras A and B: 5MVA of DSR will be used to mitigate the risk of load growth while Islington GSP is built and St Pancras substation is upgraded to 132kV.

4 Recommended strategy

The network strategy for North London is designed to ensure:

- Continued adherence to the security of supply criteria defined in Engineering Recommendation P2/6
- Maintaining reliable network operation by asset replacement, or refurbishment, of poorly performing equipment identified through asset condition monitoring (HI) techniques

The strategy is based on the reinforcement and upgrade at 132kV of heavily loaded substations in the area to supply them at 132kV from the new Islington GSP. This allows the decommissioning of the ageing Hackney-Holloway-Shoreditch 66kV network (also depending on Hearn St / Shoreditch replanting, see City Rd RDP).

The proposals are summarised below.

4.1 Asset Replacement

4.1.1 Switchgear

2589 - Hackney 66kV: Replace Switchgear

This scheme covers the replacement of the 1931 OW switchgear at Hackney Grid 66kV substation as part of the replacement strategy for obsolete and poorly performing plant. OW oil circuit breakers have a history of problems with worn mechanisms and decomposing insulated secondary wiring on the older units.

The scope of work includes an extension to the new 132kV switch house to accommodate the replacement circuit breakers which will be operated at 66kV but rated for future 132kV operation. There is a longer term objective to incrementally uprate the 66kV network to 132kV at which time the new circuit breakers will be incorporated with the existing AREVA F35 SF6 132kV switchboard.

7794 - Exeter Rd - Retrofit 11kV Switchgear

The condition assessment of the 1962 - 63 AEI QF Oil Switchgear installed at Exeter Rd has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this asset in use without compromising operational requirements; therefore this project recommends the refurbishment of all 26 circuit breakers.

7797 - Edwards Lane A - Replace 11kV Switchgear

The condition assessment of the 1998 GEC VMX Vacuum Switchgear installed at Edwards Lane A has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this asset in use without compromising operational requirements; therefore this project recommends its replacement. Completion of the project will see 28 circuit breakers replaced with 28 new circuit breakers.

4.1.2 Cables

2587 - Hackney to Exeter Road 66kV gas cable replacement

This scheme provides for the asset replacement of the Hackney-Exeter Road no 4 gas pressure cable. The 4.3km circuit was installed in 1932 and has an increasing poor fault history. The faults have been difficult to locate resulting in lengthy repair times.

The open-cut options to exit Hackney are severely restricted due to Hillstowe Street as a main access route to the NG site, River Lea and water treatment works. Therefore, it is proposed to build a short tunnel between Hackney and a site at Tallack Road (opposite the Waterloo Road substation). The new cables will be laid in the tunnel, and then will carry on from Tallack Road to Exeter Road via an open cut route.

4096 - Hackney-Exeter Rd 66kV-Replace FFC (Mollerhoj)

This scheme covers the replacement and decommissioning of Mollerhoj cable circuits, due to obsolete cable design and difficulty in obtaining sufficient specialist cable fluid as needed. This cable is to be replaced due to design issues to repair and maintain pressure to the specified standard.

8301 - Hackney-King Henrys Walk 66kV gas cables scheme

The condition assessment of the Hackney-King Henrys Walk 66kV gas cables has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising CI and CML performance, therefore this project recommends their replacement. Completion of the project will see 4km of 66kV gas cable replaced by a new 132kV cable (run at 66kV). The circuit will be rated so that it matches the rating of the future 132/11kV transformer that will be installed at King Henry's Walk when it is upgraded. Two additional ducts will be installed to allow for two replacement circuits to be laid for the 132kV upgrade.

4.2 Reinforcement

4367 - Hatchard Rd - Replant as 132/11kV substation (2x66.6MVA)

Due to forecast increasing demand levels, the substation is reaching its firm capacity. It is proposed to reinforce Hatchard Road at 132kV and to supply it from the new Islington GSP. The scope of work involves replacing the existing 15MVA 66/11kV transformers with standard dual wound 66.6MVA 132/11kV units and new 132kV cables from Islington.

This upgrade to 132kV is part of an overall strategy to decommission the 66kV network between Hackney-Holloway-Shoreditch as it is made of poor performing fluid filled cables, which would otherwise need to be replaced. The recommended option allows optimising asset replacement and reinforcement expenditure.

5741 - Waterloo Road - Replant as 132/11kV (2x66.6MVA)

Waterloo Road 11kV substation is approaching the limit of the site firm capacity. Due to space constraints at the site, carrying out ITC at the existing substation is not feasible. It is therefore proposed to build a new substation and decommission the existing one. An available plot of land has been identified nearby. This proposed substation will be supplied from Hackney Supergrid 132kV. The two 66.6MVA transformers will be fed via two new 132kV circuits that will be installed in the tunnel due to be built for the asset replacement of the Hackney-Exeter Rd circuits.

3659 - King Henry's Walk - Replant as 132/11kV substation (3x33.3MVA)

It is proposed to replace and uprate the existing 4x15MVA 66/11kV transformers with 3x33.3MVA 132/11kV units. One of the existing 66kV Hackney-King Henry's Walk circuits is to be replaced for condition under an asset replacement scheme. A 132kV circuit rated at 50MVA will be used to match the 132/11kV transformers cyclic rating and two additional ducts should be installed. The scope of this project covers the installation of 2x132kV circuits, three transformers and a new 28 panel 11kV switchboard. The substation will be fed from Hackney Supergrid 132kV.

6104 - New 132/11kV substation in Hoxton area - (2x33.3MVA)

The predicted load at Whiston Rd substation is approaching the existing firm capacity, including transfer capacity. Due to the size of the site carrying out an ITC at existing substation is inappropriate. It is therefore proposed to build a new 132/11kV substation in the Hoxton area. This proposed substation will be supplied from the new GSP at Islington, reusing the recently overlaid section of the existing Holloway-Brunswick Wharf circuits.

Completion of this project will see two new 33.3MVA transformers, a new 11kV switchboard comprising 19 circuit breakers and 6km of underground cables.

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

8340 - Hackney-Waterloo Rd cable tunnel

The circuits between Hackney and Exeter Rd need to be replaced because of poor condition (see projects 2587 and 4096 in the Asset Replacement section). A route proving study has been carried out and no open cut route has been deemed feasible to come out of Hackney substation. It is proposed to build a 1.8km long cable tunnel between Hackney and Tallack Rd to accommodate the new circuits to Exeter Rd substation. This tunnel will also later accommodate the new 132kV circuits to Waterloo Road. The project cost includes the site purchase at Tallack Rd (estimated at £2.5M according to land prices in the area).

6110 - Relocate and commission 11/6.6kV autotransformers from Islington

Following the upgrade of the Imperial College 6.6kV network to 11kV (Lodge Rd RDP), it is proposed to only feed the private network supplying the museums and college at 6.6kV. As the 22kV board at Moscow Rd will be decommissioned and a new 11kV board installed, it is proposed to reuse two of the 11/6.6kV autotransformers from Islington to supply Imperial College. The project scope is to relocate these units on site and commission them (no purchase costs for new auto transformers have been included in the Lodge Rd RDP, only costs for removing the existing transformers that need to be asset replaced).

Table 8. **Summary of transformer capacity changes**

Substation	Driver	Commissioning	Existing firm	New Firm capacity
Edwards Lane	Reinforcement	2016	58.5 MVA	82.5 MVA
Hatchard Rd	Reinforcement	2021	58.5 MVA	85.8 MVA
Waterloo Rd	Reinforcement	2022	58.5 MVA	85.8 MVA
MSS in Hoxton (to replace Whiston	Reinforcement	2025	48 MVA	85.8 MVA

4.3 Costs and phasing

Table 9 below, details the projects proposed for the remainder of DPCR5 and ED1.

Table 9. **Summary of Proposed Interventions**

Cat.	Reference	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
A	1.07.90.2587	Hackney to Exeter Road 66kV Gas Cable Replacement	0	0	0	91	1,733	243	0	0	0	0
A	1.07.90.8301	Hackney-King Henrys Walk 66kV Gas Cable Scheme	0	2,560	2,560	0	0	0	0	0	0	0
A	1.48.09.2589	Hackney 66kV: Replace Switchgear	0	0	166	2,817	7,788	2,486	0	0	0	0
A	1.50.01.7794	Exeter Rd - Retrofit 11kV Switchgear	0	0	0	0	0	139	266	0	0	0
A	1.50.01.7797	Edwards Lane A - Replace 11kV Switchgear	0	275	945	709	0	0	0	0	0	0
H	1.29.01.4096	Hackney-Exeter Rd 66kV-Replace FFC (Mollerhoj)	0	0	0	947	1,016	0	0	0	0	0
R	1.34.07.6110	Relocate and Commission 11/6.6kV Autotransformers from Islington	0	0	26	77	0	0	0	0	0	0
R	1.35.05.2576	Demand Side Response at St Pancras A and B	0	0	75	75	0	0	0	0	0	0
R	1.35.05.8554	Demand Side Response at Whiston Rd Substation	0	0	0	0	0	0	0	0	75	75
R	1.35.07.3659	King Henrys Walk - Replant as 132/11kV substation (3x33.3MVA)	0	0	0	0	51	1,735	4,745	3,520	663	0
R	1.35.07.4367	Hatchard Rd - Replant as 132/11kV substation (2x66.6MVA)	0	0	0	44	844	5,578	4,466	1,164	0	0
R	1.35.07.5741	Waterloo Road - Replant as 132/11kV (2x66.6MVA)	0	0	0	0	73	96	1,587	5,867	4,569	985
R	1.35.07.6104	New 132/11kV Substation in Hoxton area - (2x33.3MVA)	0	0	0	0	0	0	44	1,638	5,313	3,321
R	1.37.09.8340	Hackney - Waterloo Rd Cable Tunnel	203	1,537	4,098	6,149	5,123	191	0	0	0	0

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

4.4 HI / LI Improvement

A summary of the forecast HI and LI profiles post intervention are detailed below.

Asset Health Indices

Red numbers indicate changes due to ED1 projects.

Table 10. **HV Circuit Breakers (6.6 and 11kV)**

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
BLACKHORSE LANE			21	4					6	19
EDWARDS LANE A			28			**41**				
EXETER RD			9	15	2		**26**			
HACKNEY C 6.6KV	1	43				1	43			
HATCHARD RD		19	4			**36**				
KING HENRYS WALK 11KV	4	23				**28**				
WATERLOO RD			25	1		**36**				
ST PANCRAS C			n/a			66				

Table 11. **EHV Circuit breakers (22kV)**

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
BOW NETWORK RAIL 25KV	2					2				

Table 12. **66 and 132kV Circuit Breakers**

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
BOW 132KV	10					10				
HACKNEY GRID 66KV				22		**18**				
HACKNEY SGRID 66KV				11		**13**				
HACKNEY SUPERGRID 132KV	11					**18**				
HOLLOWAY GRID 66KV	10									
KING HENRYS WALK 66KV				2						
ISLINGTON GSP			n/a			**12**				
SHOREDITCH 66kV		1			5			n/a		

Table 13. **Primary Transformers**

	2015					2023				
Substation	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
BLACKHORSE LANE		1	2					3		
BOW NETWORK RAIL 25KV	2					2				
EDWARDS LANE A		4				2		4		
EXETER RD		4					1	3		
HACKNEY C 6.6KV	1		2			1		2		
HATCHARD RD		4								
KING HENRYS WALK 11KV		4								
WATERLOO RD		3	1							

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Table 14. **Grid Transformers**

Substation	2015					2023				
	No. HI1	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**	**No. HI1**	**No. HI2**	**No. HI3**	**No. HI4**	**No. HI5**
HACKNEY GRID 66KV		2	2				2	2		
HOLLOWAY GRID 66KV		2						2		
ST PANCRAS C			n/a			3				
HATCHARD RD 132/11			n/a			**2**				
WATERLOO RD 132/11			n/a			**2**				
KING HENRY's WALK 132/11			n/a			**3**				

Table 15. **Projected Load Indices (With Investment)**

Substation	Voltage kV	2023 Load Index	
		Without Investment	With Investment
Hatchard Road	66/11	5.00	n/a
Holloway	132/11	1.00	1.00
Holloway Grid 66kV	132/66	1.00	n/a
Islington	11/6.6	n/a	n/a
Hackney C.	66/6.6	2.00	2.00
Hackney Grid 66kV.	132/66	1.00	1.00
King Henry's Walk.	66/11	5.00	n/a
Waterloo Road 132/11	132/11	n/a	1.00
Blackhorse Lane	66/11	1.00	1.00
Edwards Lane	66/11	5.00	2.00
Exeter Road	66/11	1.00	1.00
Waterloo Road	66/11	5.00	n/a
St Pancras C	132/11	1.00	1.00
Hatchard Road	132/11	n/a	1.00
King Henry's Walk	132/11	n/a	1.00
Whiston Rd	33/11	5.00	5.00

5 References

References	Description
Reference 1	Planning Load Estimates LPN Area 2012 – 2023 (Feb 2013, Element Energy)
Reference 2	Primary Distribution Systems Standard Running Arrangements 2012 Overview Diagrams
Reference 3	NAMP LPN Table J Less Ind 19th February 2014
Reference 4	

5.1 Appendices

Appendix	Description
Appendix A	Geographical diagram
Appendix B	Single Line Diagram – Existing Network Part 1
Appendix C	Single Line Diagram – Existing Network Part 2
Appendix D	Single Line Diagram – Existing Network Part 3

6 Document sign off

Sign-off of this Mandate certifies that the Sponsor has ratified the above and approval is sought to proceed to the development of the necessary PG&C Gate B documentation.

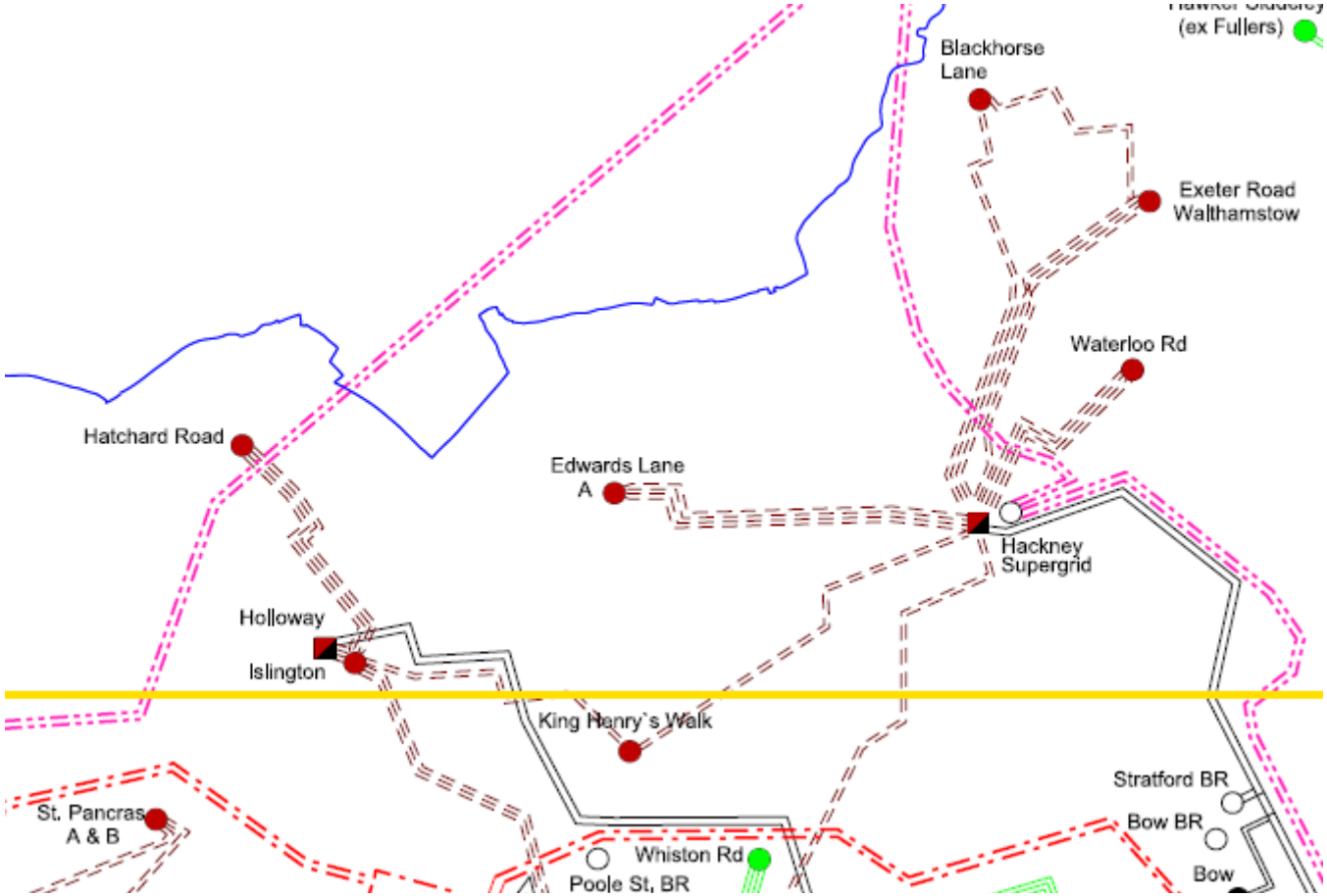
Recommended by:

Name	Role	Signature	Date
	Infrastructure Planner		
	IDP Coordinator (EPN/LPN/SPN)		
	Planning Manager (North / South)		

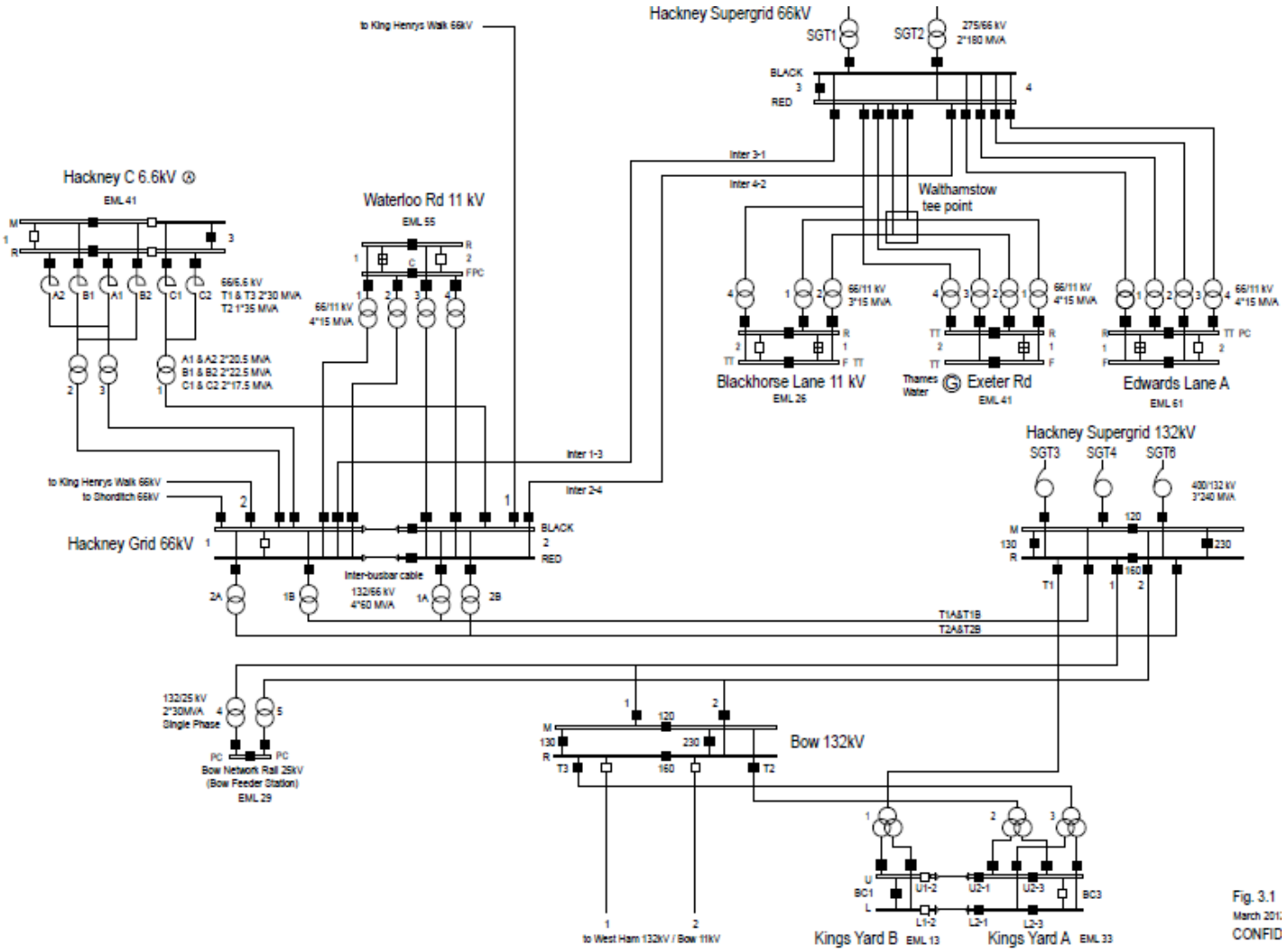
Approval by:

Name	Role	Signature	Date
Robert Kemp	Head of System Development	Robert Kemp	

APPENDIX A: GEOGRAPHICAL DIAGRAM



APPENDIX B: SINGLE LINE DIAGRAM – EXISTING NETWORK (PART 1)



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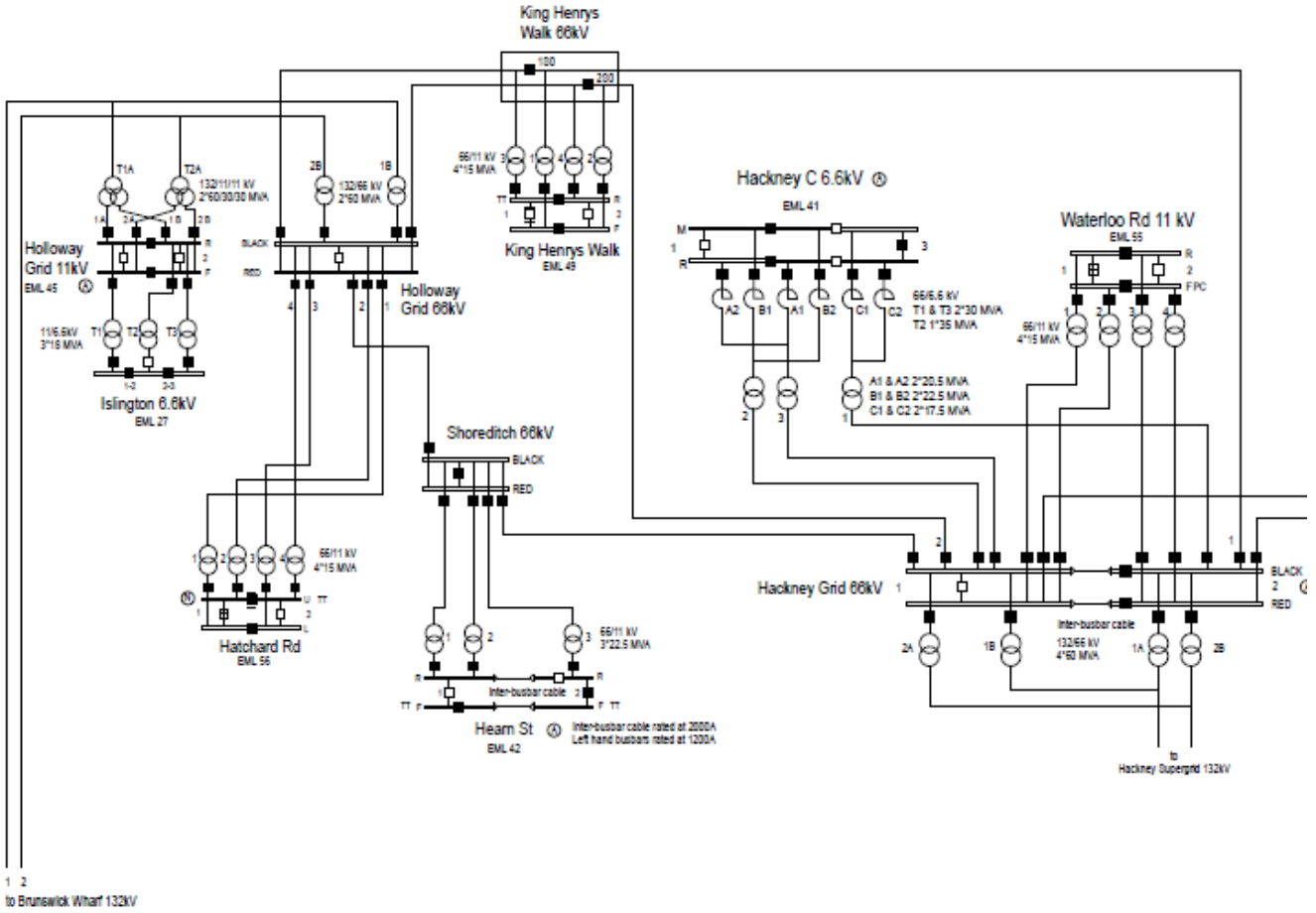
APPENDIX C: SINGLE LINE DIAGRAM – EXISTING NETWORK (PART 2)



APPENDIX D: SINGLE LINE DIAGRAM – EXISTING NETWORK (PART 3)